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Crossbred Beef Cattle for the Northern Great Plains

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INTRODUCTION

The northern Great Plains are well adapted to range beef-cattle production and have been largely utilized for that purpose since about 1870. This area comprises approximately 130,000,000 acres of land in Montana, Wyoming, North Dakota, and South Dakota. Precipitation varies from 12 to 18 inches per year, thus making most of this area unsuitable for general farming. It has been estimated that approximately 75 percent of the land in the northern Great Plains is utilized as grazing land. The range cattle on these plains are largely of Hereford breeding, but limited numbers of Aberdeen Angus and Shorthorn are also found. Crossbreeding of beef cattle has not been commonly practiced though there are isolated ranches where some crossbreeding is carried on.

Most of the experiments on crossbreeding of beef cattle have been conducted in either the Gulf Coast range area or the Corn Belt. Black and coworkers *(1)*[2] and Rhoad and Black *(7)* have reported greater weight-for-age for crosses between the Brahman and breeds of English origin in the Gulf coast area than for the

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[2] Numbers in parentheses refer to Literature Cited, p. 15.

English breeds. Wentworth *(10)* reported a crossbreeding experiment at the Iowa Agricultural Experiment Station in which he concluded that "blue-gray" cattle (crosses between Shorthorn and Aberdeen-Angus or Galloway) have demonstrated their equality, or even superiority, as market animals to the parent breeds.

Hammond *(4)* reported the results on the carcasses at the Smithfield, England show. He found that the crossbreds had a higher dressing percentage than most of the purebreds and yielded a higher percentage of valuable wholesale cuts. Rife and coworkers *(8)* found that crossbred calves tended to have an intermediate length of gestation period when there was a difference between gestation periods of the two parent breeds.

Fuller *(3)* reported that Holstein × Angus steers made satisfactory gain as compared with that of purebred Holstein and purebred Angus steers. He concluded that the satisfactory records of the crossbred steers both in the feed lot and in the slaughter test indicated that the Holstein × Angus cross was worthwhile for producing fat yearling steers.

Deakin and Muir *(2)* found that crosses of yak and bison with domestic cattle showed remarkable vigor as expressed by stamina, size, and longevity. In conformation, the crossbreds tended to be intermediate between the two parental types but the yak conformation tended to be dominant over both the bison and domestic types of cattle.

In swine, Winters and associates *(11)* found that the three-breed cross excelled either the two-breed cross or the purebred breeds in the production of market pigs. The crossbred sows made excellent mothers, raising larger litters to a heavier weight at weaning. The crossbred pigs reached market weight at an earlier age than the purebreds. The three-breed crossbred pigs proved to be excellent feeders and because they were out of crossbred dams reached market weight the earliest of the crossbreds.

In 1938, the United States Range Livestock Experiment Station, Miles City, Mont., in cooperation with the Montana Agricultural Experiment Station, began an experiment to study the value of crossbreeding for this region. The experiment was concluded in 1947 after the third-generation crossbreds had been produced. This experiment was undertaken to determine (1) the value of crossbreeding for the production of beef cattle in the Great Plains area and (2) the possibilities of maintaining hybrid vigor or heterosis through continual crossing of the three principal beef breeds of cattle, namely, the Hereford, Shorthorn, and Aberdeen-Angus. It is the purpose of this circular to report the results of this experiment.

EXPERIMENTAL ANIMALS AND MANAGEMENT

All purebreds and crossbreds compared in this experiment were produced at the United States Range Livestock Experiment Station under a cooperative project between the Bureau of Animal Industry of the United States Department of Agriculture and the

Montana Agricultural Experiment Station. The first cross was made between Shorthorn bulls and Hereford cows. The first-generation females were then mated to purebred Aberdeen-Angus bulls to produce the second generation. The third generation resulted from mating purebred Hereford bulls to second-generation females. These three crosses are shown in figure 1. In this circular, each cross is referred to by generation number.

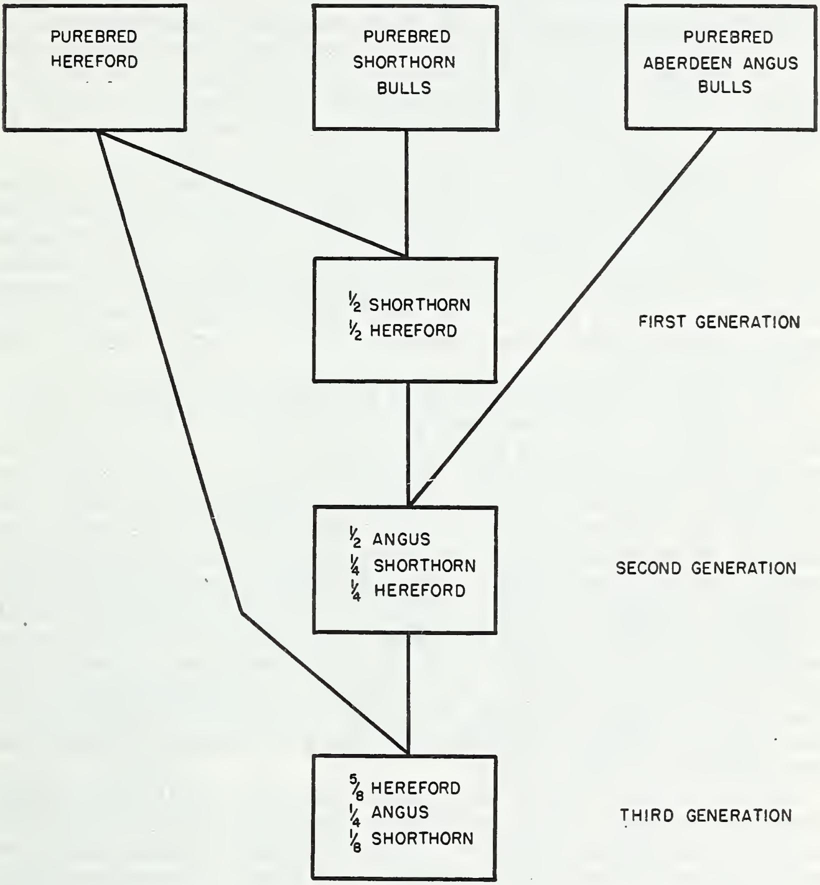

FIGURE 1.—Crossbreeding method used in experiment.

All the bulls used in the experimental work were registered animals. There were 2 Shorthorns, 2 Aberdeen-Angus, and 44 Herefords. Five of the Herefords were used to produce the third-generation crossbreds, and all 44 of the Herefords to produce the purebred progeny. The Shorthorns came from the Agricultural Research Center, Beltsville, Md., were full brothers sired by Sni-A-Bar Type and out of Zara Groat 7th. One of the Aberdeen-Angus bulls traced to Earl Marshall breeding and the other to Revolution breeding. The Hereford sires traced to Prince Domino and Beau

Mischief breeding. The females used to produce the first cross were random selected from the unregistered purebred Hereford cows at the Miles City station. These females represented nearly all the lines of breeding common in Herefords today, with a predominant amount of Prince Domino breeding.

All calves were born on the range during April and May of each year and were weaned on the same day, about October 20. Except for those of the third-generation, all steers were placed on feed in individual feeding stalls. All third-generation steers, as well as the purebreds with which they were compared, were given a 10-day to 2-week initial period before the beginning of the 252-day feeding period. All steers were individually fed except in 1946-47, when both crossbred and purebred steers were fed in small lots with each group of steers from each sire in a separate lot.

For comparison, five to eight purebred Hereford steer calves from each Hereford sire were fed under the same conditions as the crossbreds. All heifer calves, both crossbred and purebred, were used in the analyses and both groups were handled under identical conditions. The third-generation heifers were all spayed at approximately 1 year of age, since at that time the project was near completion and these females were no longer needed for breeding purposes.

The feeding periods of the steers in 1939–40 and 1940–41, when the first-generation crossbreds were fed, were 281 and 265 days, respectively; in 1941–42 and 1942–43, for the second-generation crossbreds, 273 and 259 days, respectively; and in each of the two following years, for the third-generation crossbreds, 252 days. In 1939–40 the concentrates for both purebreds and crossbreds consisted of 50 percent No. 2 yellow corn and 50 percent dried molasses-beet pulp. From 1940 to the end of the experiment, the concentrates consisted of 6 parts of No. 2 yellow corn, 3 parts of dried molasses-beet pulp, 1 part of wheat bran, 1 part of linseed meal, and one-half part of alfalfa meal or alfalfa leaf meal. Alfalfa hay was fed during all years. At the end of the feeding period, all steers were shipped to South St. Paul, Minn., market, where they were sold for slaughter. Slaughter steer and carcass grade data were obtained at that time.[3]

During the first winter all females received alfalfa hay in lots located at headquarters. The following spring they were turned out on native pasture until October, when 18-month weights and scores were obtained. During the second winter they were kept on fields near headquarters. During all subsequent winters they remained on rough areas of the station and were fed a supplement of 75 pounds of cottonseed cake per animal.

Statistical analyses of these data were made by the method of variance and covariance analyses *(9)*. Significance of differences between crossbred and purebred groups was determined by testing with sire variances. Thus, where significant differences are indicated, it is concluded that these differences were not due to chance differences between the sires that composed the population but were differences due to the effect of crossbreeding.

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[3] The live and carcass grades of the slaughter steers were obtained through the cooperation of the St. Paul, Minn., office of the Livestock Branch, Production and Marketing Administration, U. S. Department of Agriculture.

EXPERIMENTAL RESULTS

First-generation crossbred steers

The performance data for the purebred steers and for the first-generation crossbreds are shown in table 1. In both years the crossbreds had heavier birth, weaning, and final feed-lot weights than the purebreds raised under identical conditions. The crossbred steers gained significantly more rapidly in the feed lot in both years than did the purebreds. In 1939–40, when the concentrate ration was poorer, the difference was only 0.09 pound per day; but in 1940–41, when an adequate ration was fed ad libitum, the difference was 0.27 pound per day in favor of the crossbreds. In both years, the crossbreds ate more concentrates and hay than the purebreds and used their feed with slightly better efficiency.

Table 1.—*Average weights, feed consumption, grades, and returns per steer for purebred Hereford and first-generation crossbred (Shorthorn × Hereford) steers*

Item	1939–40		1940–41	
	Purebreds	Crossbreds	Purebreds	Crossbreds
Steers ....number..	29	23	38	34
Sire groups ....do....	4	2	5	2
Birth weight ....pounds..	79.5	83.2	79.1	84.8
Age at weaning ....days..	181.8	184.5	180.3	174.7
Weaning weight ....pounds..	402.6	429.1	402.6	416.8
Final feed-lot weight ....do....	875.4	927.6	883.5	968.3
Feed-lot gain ....do....	472.8	498.5	480.9	551.5
Daily gain on feed ....do....	1.68	1.77	1.81	2.08
Feed consumed per steer:				
Grain mixture ....do....	2,763.1	2,910.5	2,691.2	3,015.4
Alfalfa hay ....do....	1,016.4	1,039.9	1,051.1	1,251.5
Total digestible nutrients ..do....	2,674.3	2,800.4	2,628.2	2,982.4
Gain per 100 pounds' total digestible nutrients consumed ....do....	17.68	17.80	18.30	18.49
Sales weight ....do....	853.8	902.8	850.8	927.6
Cold-carcass weight ....do....	500.2	536.8	497.6	558.8
Dressing percentage ....percent..	57.1	57.9	56.3	57.7
Slaughter-steer grade	(1)	(1)	(1)	(1)
Carcass grade	(1)	(2)	(1)	(1)
Cost of feed per 100 pounds' gain ....dollars..	7.16	7.12	8.28	8.18
Sales price per hundredweight ....do....	10.50	10.34	11.58	11.64
Sales value per steer ....do....	89.37	93.33	98.57	107.92
Total cost per steer of feed and marketing ....do....	40.20	42.44	47.12	53.08
Returns per steer above feed and marketing costs ....do....	49.17	50.89	51.45	54.84

[1] Average good.

[2] High good.

In slaughter and carcass grades the crossbreds were slightly superior to the purebreds, owing partly to greater gain while on feed. Both the crossbreds and purebreds sold at nearly the same price per pound on the market, but the crossbred steers returned more above feed and marketing costs than did the purebreds. The difference is due entirely to the greater number of pounds of beef marketed.

In general, the crossbred steers were growthy, of good type, and finished well at 900 pounds' live weight. They went on feed readily and were easy to keep on feed. In fact, observations made on frequency of digestive disorders, as reported by Phillips and coworkers *(6)*, indicated that they experienced significantly less digestive trouble than the purebreds.

Second-generation crossbred steers

The performance data for the purebreds and second-generation crossbred steers (Angus × Shorthorn × Hereford) for each of the 2 years of feeding are shown in table 2. In both years, the purebreds were slightly heavier at birth than the crossbreds. This is due in part to the fact that the crossbred dams of the second-generation

TABLE 2.—*Average weights, feed consumption, grades, and returns per steer for purebred Hereford and second-generation crossbreds (Angus × Shorthorn × Hereford)*

Item	1942–43		1943–44	
	Purebreds	Crossbreds	Purebreds	Crossbreds
Steers number	45	6	46	18
Sire groups do	6	1	6	2
Birth weight pounds	83.4	78.3	79.2	79.1
Age at weaning days	174.8	180.2	174.7	176.1
Weaning weight pounds	394.9	438.8	386.2	440.9
Final feed-lot weight do	923.3	1,007.7	850.7	940.8
Feed-lot gain do	528.5	569.0	464.5	499.9
Daily gain on feed do	1.94	2.08	1.79	1.93
Feed consumed per steer:				
Grain mixture do	3,122.1	3,444.8	2,685.2	3,086.4
Alfalfa hay do	910.4	1,133.7	1,005.5	1,093.6
Total digestible nutrients do	2,857.6	3,229.9	2,555.7	2,905.8
Gain per 100 pounds' total digestible nutrients consumed do	18.43	17.62	18.17	17.20
Sales weight do	899.3	999.2	827.8	921.4
Cold-carcass weight do	545.3	615.8	493.7	562.2
Dressing percentage percent	59.0	61.1	58.0	59.8
Slaughter-steer grade	(1)	(2)	(1)	(3)
Carcass grade	(1)	(2)	(4)	(3)
Cost of feed per 100 pounds' gain dollars	10.42	10.78	12.71	13.48
Sales price per hundredweight do	14.58	15.25	15.50	16.05
Sales value per steer do	131.15	152.37	128.28	147.90
Total cost per steer of feed and marketing do	61.89	68.97	66.56	74.69
Returns per steer above feed and marketing costs do	69.26	83.40	62.72	73.21

[1] High good. [2] Average choice. [3] Low choice. [4] Average good.

steers were all 3- or 4-year-old cows at the time of calving, whereas the dams of the purebreds were of all ages. At weaning time, however, the crossbred steers were significantly heavier than the purebreds. This superiority in weight was maintained throughout the feeding season, and final feed-lot weight was also in favor of the crossbreds. The crossbred steers gained more rapidly on feed both years. However, they ate more grain and hay and were less efficient in the use of their feed than the purebreds. In both slaughter-steer and carcass grades, the crossbreds were one-third to one-half a grade superior to the purebreds. The crossbreds were also significantly superior in dressing percentage.

In both years, the crossbreds were higher in cost of feed per 100 pounds of gain and in total feed and marketing costs. They sold at a higher price per hundredweight and because of this fact and their greater weight they brought about $20 more per head and yielded a net return of $11 to $14 more per head than the purebreds.

The superiority of the crossbreds was most pronounced at weaning time. The fact that when both groups were given equal opportunity in the feed lot the crossbreds did not significantly outgain the purebreds seems to indicate that the crossbreds did not possess superior gaining ability. The first-generation cows undoubtedly furnished sufficient milk for rapid gains before weaning, and much of the superiority of the crossbreds in weight may be attributed to this one factor. The crossbreds were easy to keep on feed, finished well, and were relatively free of digestive disturbances.

THIRD-GENERATION CROSSBRED STEERS

The performance data for the purebreds and third-generation crossbred steers (Hereford × Angus × Shorthorn × Hereford) for each of the 2 years of steer feeding are shown in table 3. In 1945–46, the crossbred steers were lighter at birth than the purebreds, but this situation was reversed in 1946–47. The light birth weights the first year are undoubtedly due to the fact that all the dams were first-calf 3-year-old heifers, whereas the dams of the purebreds were of all age groups. In 1946–47, only about half of the dams were 3-year-olds; the remainder were 4-year-old cows. At weaning time, the crossbreds were approximately 60 to 100 pounds heavier than the purebreds. In view of the fact that the crossbreds were from younger cows, they had exceptionally high weaning weights. In final weight, the crossbreds were about 135 pounds heavier in 1945–46 and 105 pounds heavier in 1946–47. These differences are highly significant. Rate of gain in the feed lot was also significantly in favor of the crossbreds. The crossbred steers ate more grain and hay than the purebreds, and were less efficient in the use of their feed in 1946–47. In both slaughter-steer grade and carcass grade the crossbreds were significantly superior to the purebreds.

In 1945–46 the crossbreds were slightly lower in feed costs per 100 pounds of gain but in 1946–47 they were higher in this respect. The crossbred steers sold at about $1 per hundredweight more than the purebreds, and owing to the higher selling price and greater weight the crossbreds brought $44 more in 1945–46 and $37 more in 1946–

TABLE 3.—*Average weights, feed consumption, grades, and returns per steer for purebred Hereford and third-generation crossbreds (Hereford × Angus × Shorthorn × Hereford)*

Item	1945–46		1946–47	
	Purebreds	Crossbreds	Purebreds	Crossbreds
Steers ... number	63	4	98	16
Sire groups ... do	8	1	15	4
Birth weight ... pounds	79.9	76.0	82.8	88.3
Age at weaning ... days	174.5	174.3	177.4	179.6
Weaning weight ... pounds	373.3	432.0	402.4	502.6
Final feed-lot weight ... do	864.8	1001.8	958.9	1064.0
Feed-lot gain ... do	483.8	561.3	574.2	606.9
Daily gain on feed ... do	1.92	2.23	2.28	2.41
Feed consumed per steer:				
Grain ... do	2799.5	3203.8	3426.2	3882.4
Alfalfa hay ... do	761.5	928.9	892.2	1014.8
Total digestible nutrients ... do	2517.9	2910.8	3060.2	3470.8
Gain per 100 pounds' total digestible nutrients consumed ... do	19.25	19.28	18.76	17.49
Sales weight ... do	818.2	967.5	927.6	1028.1
Cold-carcass weight ... do	492.0	598.0	557.7	624.6
Dressing percentage ... percent	56.9	59.7	58.9	58.7
Slaughter-steer grade ...	(1)	(2)	(1)	(2)
Carcass grade ...	(1)	(3)	(4)	(2)
Cost of feed per 100 pounds' gain ... dollars	14.40	14.25	19.72	21.19
Sales price per hundredweight ... do	21.80	23.00	28.67	29.50
Sales value per steer ... do	178.35	222.53	265.99	303.30
Total cost per steer of feed and marketing ... do	76.71	88.27	121.40	137.39
Returns per steer above feed and marketing costs ... do	101.65	134.26	144.58	165.91

[1] High good. [2] Average choice. [3] High choice. [4] Low choice.

47 per head on the market. They yielded a net return of about $33 and $21 more per head, respectively, than the purebreds.

The third-generation crossbreds showed a distinct superiority over the purebreds from birth to slaughter in both weight and conformation. They were definitely superior in gains during all periods of growth. Three of the Hereford bulls used to produce the third-generation crossbreds had progeny tests in previous years when used with purebred cows. Without exception, the crossbred progeny significantly outgained the purebred progeny from the same bull, the differences in daily gain being 0.16, 0.57, and 0.41 pound, respectively. The third-generation crossbreds were easy to keep on feed, finished well, and were relatively free of digestive disturbances. In general results, they were the best of the three crossbred generations in rate of gain, weight for age, and slaughter-steer and carcass grades.

FIRST-GENERATION CROSSBRED HEIFERS

The performance data for the purebred Hereford and first-generation crossbred females are shown in table 4. In both years the crossbreds were heavier at birth than the purebreds although both groups were out of random-selected Hereford cows. Differences in weaning weights were not large but were slightly in favor of the crossbreds. Weight at 18 months of age also was in favor of the crossbreds. There was no appreciable difference in score on beef conformation at weaning time.

In general, the first-cross females were large-framed animals with much natural fleshing. They grew into very large, thick-fleshed cows with large udders. They were excellent mothers, good foragers on the range, wintered equally as well as the Herefords, and when fresh in the spring gave an abundance of milk. They ranged from nearly solid red with brockle faces to very light roan with red ears and legs.

TABLE 4.—*Average weights and scores per heifer for purebred Herefords and first-generation crossbreds*

Item	1939–40		1940–41	
	Purebreds	Crossbreds	Purebreds	Crossbreds
Heifers ....number..	21	23	34	30
Sire groups ....do....	2	2	3	2
Birth weight ....pounds..	76.7	77.0	72.4	77.1
Weaning weight ....do....	388.7	390.7	384.7	395.7
Age at weaning ....days..	178.1	175.9	185.3	177.5
Gain birth to weaning ....pounds..	312.1	313.7	312.3	318.5
18-month weight ....do....	737.9	765.8	717.9	784.6
Weaning score [1]	75.2	75.7	73.5	73.8

[1] Expressed as percentages on the basis that 100 percent would represent the score of the ideal beef-type animal, and 30 percent that of the poorest type.

SECOND-GENERATION CROSSBRED HEIFERS

The performance data for the purebred Herefords and second-generation (Angus × Shorthorn × Hereford) crossbreds are shown in table 5. The crossbreds were slightly lighter at birth than the purebreds, probably owing to the fact that the crossbreds were out of young cows whereas the purebreds were out of cows of all ages. At weaning time, however, the crossbred females were significantly heavier than the purebreds. Differences in weight in-

TABLE 5.—*Average weights and scores per heifer for purebred Herefords and second-generation crossbreds*

Item	1942–43		1943–44	
	Purebreds	Crossbreds	Purebreds	Crossbreds
Heifers ....number..	55	13	68	24
Sire groups ....do....	8	1	8	2
Birth weight ....pounds..	78.2	74.2	74.9	74.7
Weaning weight ....do....	379.4	415.5	377.1	419.1
Age at weaning ....days..	173.8	177.3	173.3	176.3
Gain birth to weaning ....pounds..	301.2	341.3	302.2	344.4
18-month weight ....do....	709.4	791.8	700.5	767.4
Weaning score [1]	74.7	75.6	69.5	78.4

[1] See footnote of table 4.

creased from weaning to 18 months in favor of the crossbreds. Score at weaning was also significantly in favor of the crossbreds.

The second-generation crossbreds were smaller framed, thicker fleshed cows than the first-generation and were also excellent mothers with an abundance of milk. They were good foragers, wintered equally as well as the first generation, and put on flesh readily when dry. They ranged from solid black to light blue roan, and about half of them had white or brockle faces.

THIRD-GENERATION CROSSBRED HEIFERS

The performance data for the purebred Hereford and third-generation crossbred heifers are shown in table 6. In birth weight, the crossbreds were lighter than the purebreds, owing largely to the fact that the dams of the former were 2- and 3-year-old cows whereas those of the purebreds were of all ages. In weaning weight the crossbreds were materially heavier than the purebreds in spite of the fact that the crossbreds were out of young cows. Score at weaning was also materially in favor of the crossbred heifers. Yearling weights favored the crossbreds, but the differences were not so great as at weaning time, possibly owing to the effects of spaying of the crossbreds when about a year of age.

TABLE 6.—*Average weights and scores per heifer for purebred Herefords and third-generation crossbreds*

Item	1945–46		1946–47	
	Purebreds	Crossbreds	Purebreds	Crossbreds
Heifers ____number__	96	3	156	11
Sire groups ____do____	10	1	16	4
Birth weight ____pounds__	76.5	66.3	76.8	75.9
Weaning weight ____do____	352.4	404.7	375.1	464.8
Age at weaning ____days__	176.4	172.3	180.5	178.6
Gain birth to weaning ____pounds__	275.9	338.3	298.3	388.9
18-month weight ____do____	683.0	804.7	707.5	728.9
Weaning score [1] ____	71.8	82.0	66.6	78.1

[1] See footnote of table 4.

No information is available on the third-generation crossbreds when mature. As calves and yearlings, they were the most promising of the three crosses studied. There were approximately equal numbers of red and black animals. Nearly all had white or brockle faces and there were a few roans, both red and blue.

GROWTH TO MATURITY AND CALF PRODUCTION OF CROSSBRED FEMALES

The growth curves of the first- and second-generation crossbred females and the purebred Herefords from birth to 5 to 6 years of age are shown in figure 2.

These curves indicate that the second-generation females were the heaviest up to 18 months of age but from that time the first-generation heifers were the heaviest. At 5 years of age, the first-generation cows were approximately 100 pounds heavier than

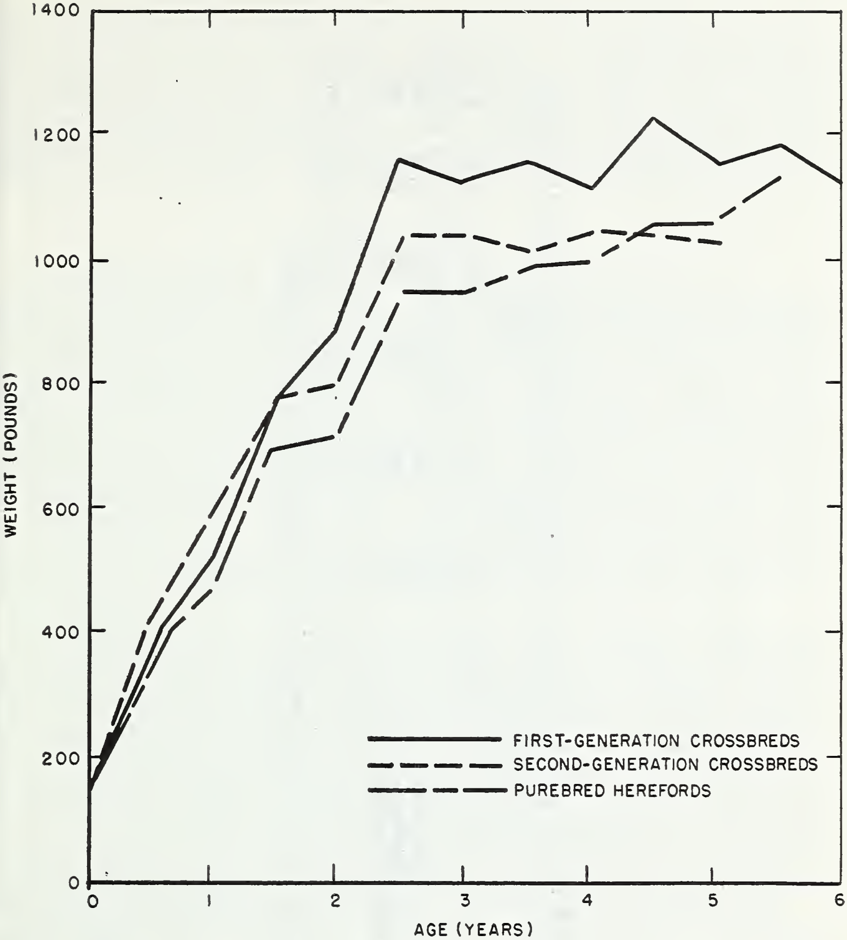

FIGURE 2.—Weights of the purebreds and first two generations of crossbreds from birth to maturity.

those of the second generation. Up to 4 years of age, the Herefords grew more slowly than either of the crossbred groups, but at 5 years of age they were heavier than the second-generation cows but lighter than those of the first generation. The superior milking quality of the first-generation cows apparently was largely responsible for the heavier weights of the second-generation cows up to the first year of age. The infusion of Angus breeding resulted in smaller mature size of the second-generation females.

The calf-crop percentages of the crossbreds and the purebred Herefords are shown in table 7. The Hereford cows bred to Shorthorn bulls produced 5.1 percent higher calf crop than those bred to Hereford bulls. Since both groups of cows were random-selected from the unregistered herd it would appear that the use of another breed of bull may result in higher calf-crop percentage.

TABLE 7.—*Number of calves and calf-crop percentages of purebred and crossbred groups of females*

Years	Breeding of females used to produce crossbreds	Breeding of bulls used to produce crossbreds	Purebreds		Crossbreds		Calf crop[1]	
			Cows	Calves	Cows	Calves	Purebreds	Crossbreds
			Number	*Number*	*Number*	*Number*	*Percent*	*Percent*
1939–40	Hereford	Shorthorn	121	106	123	114	87.6	92.7
1942–43	Shorthorn × Hereford	Angus	405	305	74	63	75.3	85.1
1945–46	Angus × Shorthorn × Hereford	Hereford	631	542	47	35	85.9	74.5
Total or average			1,157	953	244	212	82.4	86.9

[1] Percentage calf crop based on number of cows bred (spring count) and number of calves weaned.

The first-generation cows produced 9.8 percent higher calf crop than the purebred Herefords. However, the second-generation produced 11.4 percent fewer calves per 100 cows than did the purebred Herefords. The cause of this lower calf crop in this generation is not known. In general, however, for all generations, the crossbreds had slightly higher calf-crop percentages than the purebreds.

DISCUSSION

The data presented indicate that all three generations of crossbreds were better in nearly every characteristic than the purebreds fed during the same year and handled as nearly the same as possible. In progeny groups from individual sires among both the purebreds and the crossbreds, considerable variation was found. For example, in daily gain in the feed lot, four purebred Hereford sire groups outgained the crossbreds and four others gained equally as well. Purebred-sire groups were also observed that weighed more at the end of the feeding period, that sold for as much per hundredweight, and that returned more money over feed and marketing costs than did the crossbreds. None of these superior bulls were used to produce crossbreds in the third generation because of their usefulness in another project.

Of eight bulls whose progeny on feed showed equal or superior gaining ability to the crossbreds, seven are from one inbred line that has shown superior merit in rate of gain. However, in the case of the three Hereford bulls used in both purebred and crossbred herds, the crossbred progeny materially outgained the purebred progeny from the same sire. The same statement applies to the Shorthorn bulls, based on tests at Beltsville. These results seem to indicate that the best results from crossbreeding are dependent on the procuring of good bulls, but indications are that the progeny of all bulls in this experiment performed better when out of females of a different breed than when out of females of the same breed as the bull.

For range producers of feeder cattle, crossbreeding has a distinct disadvantage that should be mentioned. Order buyers of feeder cattle tend to purchase steers of uniform breeding, type, size, color, and quality. Thus, crossbred cattle with mixed colors are often discriminated against with a resulting lower price per hundredweight. The feeder buyer may be justified in his antipathy to off colors, because of the fact that inferior bred animals of poor fattening qualities may appear similar to the better bred crossbreds especially at the younger ages. Yet the finishing qualities of the two are sure to be different. It would seem, therefore, that unless the range producer is either selling direct to the feeder or producing grass-fat steers, the advantages of crossbreeding are largely lost on the feeder market. Such a disadvantage does not exist on the fat-cattle market where purchase is made on finish, quality, and killing yield.

The crossbred females were excellent range cows, high in fertility, and produced very heavy calves at weaning time. There seems to be a distinct advantage in crossbreeding from the female standpoint. The second- and third-generation calves appeared to profit as much from the fact that they were out of crossbred cows as from being crossbreds themselves. Milk production of the crossbreds was high yet it was not necessary to milk out any of the crossbred cows to prevent spoiling of the udders.

The conclusion seems sound that crossbreeding can be carried on most profitably where the range producer is able to crossbreed systematically and where he either feeds his own steers or sells direct to the feeder.

SUMMARY

Data are presented on the results of a crossbreeding experiment at the United States Livestock Experiment Station, Miles City, Mont., conducted in cooperation with the Montana Agricultural Experiment Station. The experiment was designed to test the possibilities of maintaining hybrid vigor through the use of sires from the beef breeds and of crossbred females. Comparisons between purebred Hereford and crossbred steers and heifers were made for each of three crossbred generations, which were as follows: First generation, Shorthorn bulls × Hereford cows; second generation, Aberdeen Angus bulls × first-generation cows; third generation, Hereford bulls × second-generation cows.

First-generation crossbred steers had significantly heavier weaning and final feed-lot weights than the purebreds and gained significantly more in the feed lot. Significant differences were not observed in birth weight, slaughter-steer grade, nor carcass grade.

Second-generation crossbred steers had significantly heavier weaning and final feed-lot weights than the purebreds but did not gain significantly more in the feed lot. Significant differences were observed in slaughter-steer and carcass grades. The crossbred steers were lighter at birth than the purebreds but the difference was not significant.

Third-generation crossbred steers had significantly heavier weaning and final feed-lot weights and gained significantly more in the feed lot. These crossbred steers also graded significantly higher as slaughter steers and in the carcass. There was no significant difference in birth weight.

In the females, the weaning weight and weaning score of the crossbreds improved with each generation and all generations were superior to the purebreds. The weights of the heifers at 18 months were also in favor of the crossbreds. The first-generation crossbreds were the heaviest at maturity, followed in order by the purebred Herefords and the second-generation crossbreds.

Growth studies indicate that the first-generation females reach the heaviest mature weight, but up to 18 months of age the second-generation crossbreds were heavier than the first generation. The purebred Hereford females were the lightest of the three groups up to 5 years of age when they became intermediate in weight between the first- and second-generation crossbred females.

The calf-crop percentages as a whole were higher for the crossbreds than for the purebreds.

LITERATURE CITED

(1) Black, W. H., Semple, A. T., and Lush, J. L.
1934. BEEF PRODUCTION AND QUALITY AS INFLUENCED BY CROSSING BRAHMAN WITH HEREFORD AND SHORTHORN CATTLE. U. S. Dept. Agr. Tech. Bul. 417, 53 pp., illus.

(2) Deakin, Alan, and Muir, G. W.
1935. HYBRIDIZATION OF DOMESTIC CATTLE, BISON AND YAK. Canada Dept. Agr. Pub. 479, Tech. Bul. 2, 31 pp., illus.

(3) Fuller, J. G.
1928. CROSSBREEDING TYPES FOR BABY BEEF PRODUCTION. Amer. Soc. Anim. Prod. Proc. 1927: 53–57.

(4) Hammond, J.
1920. ON THE RELATIVE GROWTH AND DEVELOPMENT OF VARIOUS BREEDS AND CROSSES OF CATTLE. Jour. Agr. Sci. [England] 10:233–289.

(5) Knapp, Bradford Jr., Baker, A. L., Quesenberry, J. R., and Clark, R. T.
1941. GROWTH AND PRODUCTION FACTORS IN RANGE CATTLE. Mont. Agr. Expt. Sta. Bul. 400, 13 pp., illus.

(6) Phillips, R. W., Black, W. H., Knapp, Bradford Jr., and Clark, R. T.
1942. CROSSBREEDING FOR BEEF PRODUCTION. Jour. Anim. Sci. 1:213–220.

(7) Rhoad, A. O., and Black, W. H.
1943. HYBRID BEEF CATTLE FOR SUBTROPICAL CLIMATES. U. S. Dept. Agr. Cir. 673, 11 pp., illus.

(8) Rife, D. C., Gerlaugh, P., Kunkle, L., Brandt, G. W., and Snyder, L. W.
1943. COMPARATIVE LENGTHS OF GESTATION PERIODS OF ABERDEEN ANGUS AND HEREFORD COWS CARRYING PUREBRED AND CROSSBRED CALVES. Jour. Anim. Sci. 2:50–52.

(9) Snedecor, George W.
1946. STATISTICAL METHODS APPLIED TO EXPERIMENTS IN AGRICULTURE AND BIOLOGY. Ed. 4, 485 pp., illus. Ames, Iowa.

(10) Wentworth, E. N.
1912. CONCERNING "BLUE-GRAY" CATTLE. Amer. Breeder 5:9–10.

(11) Winters, L. M., Kiser, O. M., Jordan, P. S., and Peters, W. H.
1935. A SIX-YEARS STUDY OF CROSSBREEDING SWINE. Minn. Agr. Expt. Sta. Bul. 320, 18 pp., illus.

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